Factors associated with contracting COVID-19 at a High School in Makonde District, Zimbabwe, November 2020

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ABSTRACT

Introduction: The outbreak at a high school was reported on the 18th of November 2020, and from the 18th to the 24th, 73 cases were confirmed. We conducted an outbreak investigation to determine the factors associated with contracting COVID-19 (Corona virus Disease of 2019) at the school in Makonde district. **Methods:** We conducted an unmatched 1:1 case-control study. Cases were students with a positive polymerase chain reaction (PCR) and controls as students with a negative PCR. A sample size of 67 cases and controls was calculated and both cases and controls were selected randomly. All ethical considerations were strictly observed. Data were collected using a pretested questionnaire and the school environment was assessed using a checklist. Bivariate and multivariate analysis was conducted. **Results:** We enrolled 73 cases and 73 controls into the study. The classrooms had 39.8 (SD=13) students per each class against a capacity of 25. The boarding hostels were housing 603 students against a capacity of 400. Close contact with an infected patient (aOR 26.6; 95% CI: 10.8–64.4) was a risk factor for contracting Covid-19. Following recommended hand hygiene practices (aOR: 0.4, 95% CI: 0.25–0.97) and wearing face masks (aOR: 0.42, 95% CI: 0.20–0.82) were protective. **Conclusion:** The school was overcrowded and close contact with an infected patient was a risk factor. Good hand hygiene practice and wearing face masks was protective. We instituted strict quarantine for the cases and increased the handwashing facilities from 1 per hostel to 8-10 per hostel and reduced the intake of new students.

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Introduction

Corona Virus Disease of 2019 (COVID-19) is a viral respiratory disease first identified in Wuhan, China [1,2]. Countries have employed national lockdowns with quarantine and isolation of infected patients [3] and suspension of social events [4]. The Covid-19 pandemic has increased from an initial 44 patients [5] in China, to over 59 million cases and about 1,300,000 deaths worldwide by 15 November 2020 [6]. Over 900,000 Africans have contracted the virus [6]. Zimbabwe reported 9398 cases and 274 deaths as of 24 November 2020 [7]. The Covid-19 outbreak at the School in Makonde District, Mashonaland West Province commenced on the 18th of November 2020 with the index case testing positive for Covid-19. By the 29th of November, 73 cases had been confirmed. The outbreak posed a huge burden on the local healthcare system. The risk factors for contracting COVID-19 in high school students have not been fully characterized. We conducted an outbreak investigation to determine the factors associated with contracting COVID-19 at the School in Makonde District.

Methods

Epidemiological Investigation

We collected nasopharyngeal swabs from students for laboratory diagnosis using national guidelines [8]. All Polymerase Chain Reaction (PCR) positive patients were line-listed, an environmental assessment was conducted. We developed the hypothesis that hand hygiene practices were associated with contracting Covid-19.

Study Design

To minimise investigation time and with the relative rarity of Covid-19 in schools, we chose a case-control design to simultaneously assess risk factors such as handshaking, lack of social distancing, and close contact with an infected person [9]. We conducted an unmatched 1:1 case-control to test the hypothesis.

Study Setting

The government secondary school was a mixed boarding school with 1391 students in 6 forms. There were six boarding hostels at the school [10] and a staff complement of 44 teachers and 23 support staff. The school health committee had 8 members and there was no school clinic on site.

Study Participants

The study participants were students of the school present from 18-29 November 2020.

Working Definitions

A case: Any student who tested Covid-19 PCR positive who lived at the School from 18-29 November 2020.

A control: Any student who tested COVID-19 PCR negative who lived at the School from 18-29 November 2020.

Study Hypothesis

H_o = There was no association between hand hygiene practices and contracting COVID-19

H_1= There was an association between hand hygiene practices and contracting COVID-19

Sample Size

A sample size of 67 cases and 67 controls was calculated using the Fleiss formula in Epi Info 7.2.4.0™ (CDC, 2020) considering a similar study done by Ssebuufu et al, *Awareness, knowledge, attitude and practice towards measures for prevention of the spread of COVID-19 in Uganda* [11]. We assumed a 95% confidence level, a power of 80%, a 10% refusal rate and a 50% exposure in cases and 30% exposure in controls and that students not following recommended hand hygiene had an odds ratio of 2.89 of contracting Covid-19.

Sampling

We selected the cases using simple random sampling by using the RANDBETWEEN Function of Microsoft Excel. Controls were selected using systematic random selection with the line list as a sampling frame where every seventh student was selected. We selected the 8 key informants purposively.

Data Collection

We pretested the questionnaire at a local nursing school. We conducted interviews to collect data from cases, controls and key informants. The questionnaire collected data on demographic characteristics, signs and symptoms, outcomes, risk factors, and knowledge among others. We used a checklist to assess the school´s preparedness, resource availability and

environmental assessment. We checked screening points, classroom size and availability of hand hygiene supplies.

Data Analysis
We categorised qualitative data according to themes, coded and summarized it, quantitative data was entered into the computer database and means, frequencies, tables, and odds ratios for different variables were run using Epi Info. We generated an epidemic curve of the cases and bivariate and stratified analysis was conducted to check for effect modification and confounding.

Availability of data and material
The data that support the findings of this study are available from the Ministry of Health and Child Care (Zimbabwe) but restrictions apply to the availability of these data. Data are however available from the authors upon reasonable requests and with permission of the Ministry of Health and Child Care (Zimbabwe).

Ethical Considerations
We did not collect any of the participants´ personal information. We explained the purpose, procedures involved, potential benefits, possible discomforts, participants´ right to withdraw, and risks. We sought permission to proceed from all relevant authorities and permission from parents/guardians was sought using a written indemnity form.
Written informed consent and assent were obtained from each study participant for the publication of this work.

Results

Characteristics of the Infected
We interviewed 73 Covid-19 cases and 73 controls. Among the cases, 21(28.8%) were males and 52 (71.2%) females and among the controls 20 (27%) male and 53 (73%) female. The median age of the respondents for cases was 15 years (Q_1=14; Q_3=16) and for controls was 14 years (Q_1=13; Q_3=16) Table 1. We found that 64(88%) had one or more symptoms lasting an average of 4.9 days (SD 1.4). Only one patient (1.3%) had symptoms severe enough to warrant admission and there were no fatalities.

Description of the outbreak by place
All six hostels at the school were affected Figure 1. The most affected were Angevine 22(30%), Winsdor 14(19%) and Tudor 13(18%) hostels. We found the average class had 39.8 (SD 13) against a capacity of 25 students per classroom. The boarding hostels were oversubscribed by 150% with 603 students against the maximum allowed capacity of 400.

Epidemic timeline
We noted the index case tested positive for Covid-19 on 18 November. The majority of cases fell ill on the 20th of November. The median incubation period was 3 days (Q_1=2; Q_3=5). The outbreak was multi-modal with peaks occurring on the 10th, 12th, 15th, 16th, 18th, and 20th of November 2020 Figure 2. After all students had completed their isolation and quarantine period, the school was closed on 4 December 2020.

Factors associated with contracting SARS-2 at the School
On bivariate analysis students who had close contact with an infected patient were 26 times more likely to contract Covid-19 (OR 26.0 CI 95%10.8-62.6 p=0.00). Students who used recommended hand hygiene practices consistently were 52% protected (OR 0.48 95% CI 0.24-0.98 p=0.01). Consistently wearing face masks was 61% protective (OR 0.39 95% CI 0.20-0.78 p=0.01).

Independent factors associated with contracting SARS-CoV-2 (Severe Acute Respiratory Syndrome Corona Virus2)
We adjusted for age, sex, form, and boarding residency and the independent risk factor for contracting Covid-19 was close contact with the infected patient (aOR 26.6 95% CI 10.8-64.4, p=0.01), wearing face masks (aOR 0.42 95% CI 0.20-0.78 p=0.01) and following the recommended hand hygiene practices (aOR 0.4 95% CI 0.25-0.97, p=0.01) were independent protective factors Table 2.

Outbreak detection and response
The outbreak Rapid Response Team (RRT) was notified of the outbreak on 18 November and visited the school within 24 hours. We conducted mass testing of all students and instituted a lockdown of the school; day scholar classes were

suspended. All positive cases were moved to two hostels.

Discussion

We sought to investigate the outbreak to determine the factors associated with contracting COVID-19 at a High School. Our main findings were students who had close contact with an infected patient were more likely to contract Covid-19. These findings were similar to the study done by Bi et al., [12] in Shanghai, who found that the spread of Covid-19 was attributed to the close interactions among family members. The school was overcrowded this could be a possible explanation for the rapid spread of the virus at the school. James et al. also found high attack rates among congregants who attended church gatherings that were not compliant with social distancing guidelines [13]. Kedebe et al., also noted that practices such as hugging and shaking hands were risk factors for contracting Covid-19 [14].

Based on our findings, we rejected the null hypothesis, following hand hygiene practices such as handwashing with soap and water and consistent use of hand sanitizer indicate knowledge of the Covid-19 infection prevention and control measures [15, 16]. A study by Mamdooh et al., found hand hygiene a significant protective factor in preventing the spread of Covid-19 [17]. In addition, we found the use of face masks was noted to be protective against Covid-19. Howard et al., noted similarly that medical masks reduced the transmission of Covid-19 among nurses [18]. We found in the immediate aftermath of these measures no student at the school turned positive [19], however, more studies in school settings need to be done.

We noted that during the investigation, 98% of the cases had mild disease and all recovered within 5 days. The European Center for Disease Control (ECDC) report on COVID-19 noted in schools, young people have mild disease [20] with no symptoms. However, we found that 88% exhibited symptoms in contrast to several studies [1, 4, 12, 21-23] which noted between 71-85% of the Covid-19 cases were asymptomatic. There is a need to conduct further studies on this.

Limitations

We encountered communication barriers with 6(8.2%) cases who had hearing and speech impairment. We employed a sign language teacher to administer the questionnaire. The language barrier might have led to some information being lost in translation.

Conclusion

We found that close contact with an infected patient was an independent risk factor for contracting Covid-19 and the school was overcrowded. Following recommended hand hygiene practices and wearing face masks were independent protective factors. We imposed strict isolation of all cases and quarantined all their close contacts, we increased the handwashing facilities from 1 per hostel to 8-10 per hostel and reduced the intake of new students. This proved to be effective in controlling the spread of Covid-19 as there were no positive cases reported after these measures.

What is known about this topic

- Corona Virus disease of 2019 (Covid-19) is a contagious disease caused by a novel coronavirus
- The virus spreads very easily from person to person and it was noted that one person could spread to 2-3 people

What this study adds

- We found that close contact with an infected patient was an independent risk factor for contracting Covid-19 in school children
- Following recommended hand hygiene practices and wearing face masks were independent protective factors
- Strict isolation of all cases and quarantined all their close contacts is effective controlling the spread of Covid-19 in school children

Competing interests

The authors declare no competing interests whether financial and non-financial.

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Authors' contributions

KM, DB, TD, GM, EG, NG, TJ and MT: conception, design, acquisition, data collection, analysis and interpretation of data. KM and BD wrote the first draft of the manuscript. EG, NG, TJ and MT critically revised the draft for important intellectual content. All authors read and approved the final manuscript.

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Table 1: Demographic characteristics of cases and controls		
Variable	**Cases**	**Controls**
Sex		
Female	52(72%)	53(73%)
Male	21(28%)	20(27%)
Age **Median age**	15 yrs (Q_1=14, Q_3= 16))	14 yrs (Q_1=13,Q_3=16)
Which Hostel do you reside in?		
Angevine	22(30%)	3(4%)
Day Scholar	3(4%)	0(0%)
Hanover	6(8%)	6(8%)
Norman	5(7%)	6(10%)
Stuart	10(14%)	7(10%)
Tudor	13(18%)	17(23%)
Winsdor	14(19%)	34(47%)
Do you share with anyone?		
No	13(18%)	11(15%)
Yes	60(82%)	62(85%)

Table 2: Independent Factors for Contracting Covid-19 at A High school						
Risk factor	**Unadjusted**			**Adjusted**		
	OR	**95% CI**	**P-value**	**aOR**	**95% CI**	**P-value**
Face to face contact with infected patient	26.0	10.8-62.6	0.01	26.6	10.8 – 64.4	0.01
Wearing of Face masks	0.38	0.20-0.78	0.01	0.42	0.21-0.80	0.01
Practice recommended hand hygiene	0.48	0.24-0.98	0.02	0.4	0.25-0.97	0.02

Figure 1: A High School Spot Map

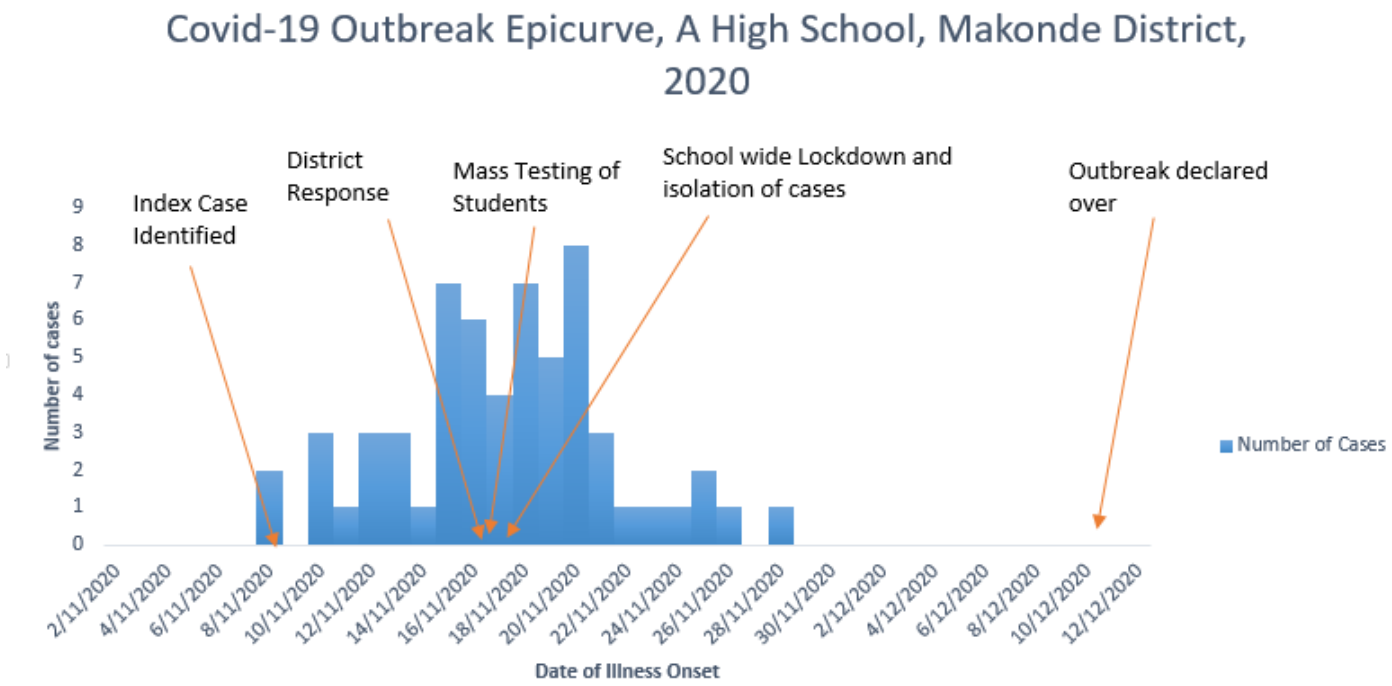

Figure 2: A High School Covid-19 Outbreak Epi-curve